CLAIMS

1. A method of successively estimating the position of a floor reaction force acting point of each leg of a biped walking mobile body, comprising:

a first step for successively grasping the position of the center of gravity of the biped walking mobile body, the position of the ankle joint of each leg, and the position of the metatarsophalangeal joint of the foot of the leg, respectively, and also successively grasping the vertical distance from the ankle joint to a ground contact surface of each leg in contact with the ground while the biped walking mobile body is in motion,

a first ground contact sensor and a second ground contact sensor being provided on the sole of the foot of each leg of the biped walking mobile body, and the first and the second ground contact sensors outputting ground contact detection signals based on whether a place directly below an ankle joint of a leg and a place directly below a metatarsophalangeal joint of the foot of the leg, respectively, are in contact with the ground; and

a second step wherein, for each leg in contact with the ground while the biped walking mobile body is in motion, the horizontal position of one of the center of gravity, the ankle joint of the leg, and the metatarsophalangeal joint of the leg, the positions thereof having been determined in the first step, is successively estimated selectively as the horizontal

position of the floor reaction force acting point of the leg on the basis of at least the combination of contact or no contact with the ground indicated by a ground contact detection signal of the first ground contact sensor and contact or no contact with the ground indicated by a ground contact detection signal of the second ground contact sensor of each leg, and the vertical position of the floor reaction force acting point of the leg is successively estimated as the position apart vertically downward from the ankle joint by the vertical distance from the ankle joint to the ground contact surface of the leg determined in the first step.

2. The method of estimating a floor reaction force acting point of a biped walking mobile body according to Claim 1, wherein, when estimating the horizontal position of the floor reaction force acting point in the second step, on each leg in contact with the ground, if a ground contact detection signal of the first ground contact sensor of each leg is a signal indicating contact with the ground and a ground contact detection signal of the second ground contact sensor of the leg is a signal indicating no contact with the ground, then the horizontal position of the ankle joint of the leg is estimated as the horizontal position of a floor reaction force acting point of the leg, or if a ground contact detection signal of the first ground contact sensor of each leg is a signal indicating

no contact with the ground and a ground contact detection signal of the second ground contact sensor of the leg is a signal indicating contact with the ground, then the horizontal position of the metatarsophalangeal joint of the leg is estimated as the horizontal position of the floor reaction force acting point of the leg, or if ground contact detection signals of both the first ground contact sensor and the second ground contact sensor of each leg are signals indicating contact with the ground and if the position of the center of gravity is behind the position of the ankle joint of the leg in the advancing direction of the biped walking mobile body, then the horizontal position of the ankle joint of the leg is estimated as the horizontal position of the floor reaction force acting point of the leg, or if ground contact detection signals of both the first ground contact sensor and the second ground contact sensor of each leg are signals indicating contact with the ground and if the position of the center of gravity is before the position of the metatarsophalangeal joint of the leg in the advancing direction of the biped walking mobile body, then the horizontal position of the metatarsophalangeal joint of the leg is estimated as the horizontal position of the floor reaction force acting point of the leg, or if ground contact detection signals of both the first ground contact sensor and the second ground contact sensor of each leg are signals indicating contact with the ground and if the

position of the center of gravity is between the position of the ankle joint and the position of the metatarsophalangeal joint of the leg in the advancing direction of the biped mobile body, then the horizontal position of the center of gravity is estimated as the horizontal position of the floor reaction force acting point of the leg.

3. The method of estimating a floor reaction force acting point of a biped walking mobile body according to Claim 1 or 2, wherein the vertical distance from the ankle joint to a ground contact surface of each leg when the biped walking mobile body is in an upright stationary state is measured and retained in a memory beforehand, and when grasping the vertical distance from the ankle joint to the ground contact surface of each leg in contact with the ground in the first step, the vertical distance retained in the memory is grasped as the vertical distance from the ankle joint to the ground contact surface of each leg in contact with the ground.

4. The method of estimating a floor reaction force acting point of a biped walking mobile body according to Claim 1 or 2, wherein

the vertical distance from the ankle joint to a ground contact surface of each leg and the vertical distance from the metatarsophalangeal joint to the ground

contact surface of the leg when the biped walking mobile body is in an upright stationary state are measured and retained in a memory beforehand as a first basic vertical distance and a second basic vertical distance, respectively,

and when grasping the vertical distance from the ankle joint to the ground contact surface of each leg in contact with the ground in the first step, if the position of the center of gravity is behind the position of the metatarsophalangeal joint of the leg in the advancing direction of the biped walking mobile body, then the first basic vertical distance is grasped as the vertical distance from the ankle joint to the ground contact surface of the leg, or if the position of the center of gravity is before the position of the metatarsophalangeal joint of the leg in the advancing direction of the biped walking mobile body, then the vertical distance between the ankle joint and the metatarsophalangeal joint of the leg is determined, and then the value obtained by adding the second basic vertical distance to the determined vertical distance is grasped as the vertical distance from the ankle joint to the ground contact surface of the leg.

5. A method of estimating a joint moment of a biped walking mobile body for estimating a moment acting on at least one joint of each leg of the biped walking mobile body by using an estimated value of the position of a

floor reaction force acting point successively determined by the method of estimating a floor reaction force acting point of a biped walking mobile body according to Claim 1, comprising:

a step for successively estimating the floor reaction force of each leg, which is in contact with the ground, of the biped walking mobile body by using at least a detection output of an acceleration sensor attached to a body of the biped walking mobile body to detect the acceleration of a predetermined part of the body and a detection output of a body inclination sensor attached to the body to detect an inclination angle of the body, and a step for successively grasping the inclination angle of each rigid corresponding part of a biped walking mobile body that corresponds to each rigid body of a rigid link model representing the biped walking mobile body in the form of a link assembly of a plurality of rigid bodies, the acceleration of the center of gravity of the rigid corresponding part, and the angular acceleration of the rigid corresponding part by using at least detection outputs of the body inclination sensor and an angle sensor attached to a joint of each leg of the biped walking mobile body to detect the bending angle of the joint,

wherein a moment acting on at least one joint of each leg of the biped walking mobile body is estimated on the basis of an inverse dynamics model by using an estimated value of the floor reaction force, an estimated value of

the position of the floor reaction force acting point, an inclination angle of the each rigid corresponding part, the acceleration of the center of gravity of the rigid corresponding part and the angular acceleration of the rigid corresponding part, weight and size of each rigid corresponding part that have been determined in advance, the position of the center of gravity of each rigid corresponding part in the rigid corresponding part that has been determined in advance, and the inertial moment of each rigid corresponding part that has been determined in advance.